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METEOROLOGY AND THE HIGH SCHOOL*

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During the last three decades the number of courses added to the high school curriculums has been increasing with an accelerated tempo. Now with war emergency courses demanding the immediate attention of high school administrators, this rapid growth has become an avalanche. Consequently, the judicious high school principal attempts to evaluate the war-born courses in terms of short-range or war expedient courses, and long-range permanent courses. The writer believes that if meteorology were given an opportunity as a war-time subject it would win a permanent place in the curriculum.

This paper will present briefly five of the many problems which should be considered before meteorology is placed in the high schools. The five problems selected for special treatment are: 1. Objectives; 2. Meteorology and the Curriculum; 3. Personnel; 4. Books and Equipment; 5. Methods.

OBJECTIVES

Altho the war is emphasizing aviation meteorology, I believe that few high school curriculums can become so diversified as to offer courses on aviation meteorology. Consequently high school meteorology should be taught as a multiple-functional course rather than a unifunctional one serving some specific occupation such as aviation or agriculture.

Most educators and administrators will agree that some of the objectives which at all events should be kept in mind in the teaching of meteorology are these.

1. To live in an Air Age and to furnish many with scientific information to aid them in flying.

* Presented at the annual High School Conference, University of Illinois, November, 1942.

2. To be conscious of the importance of healthful atmospheric conditions in industrial and commercial establishments as well as at home.
3. To understand the influence of weather upon various occupations.
4. To consider meteorology as a vital part of the physical environment in planning the future use of our natural and human resources, and
5. To secure a firm physical science foundation for further learning.

METEOROLOGY AND THE CURRICULUM

Assuming that meteorology should be studied in the high school, how much time should one allow for this subject? Should elementary meteorology be offered as a semester course, or should it be part of a year's work in Aeronautics, General Science, or Physical Geography?

At the present time it is being offered in all three ways: as a semester course in Elementary Meteorology, as part of a year's work in Aeronautics, General Science, or Physical Geography.

In stressing aeronautics, many of the large industrial high schools wanting to offer a semester's course in meteorology found that they lacked a good text. Such a text was soon written by Finch, Trewartha, Shearer and Caudle, entitled *Elementary Meteorology,* and published by McGraw-Hill.

Other high schools have placed a year of aeronautics in their curriculum. Most of the texts written for a year of high school aeronautics contain a unit on meteorology. In *Elements of Aeronautics* by Pope and Otis, Part IV, "Meteorology," occupies 107 pages of the 642 pages of subject matter. In Collins' *Elements of Pre-Flight Aeronautics for High School,* Unit II is entitled "The Ocean of Air," and one-sixth of the subject matter is devoted to meteorology. *Science of Pre-Flight Aeronautics for High Schools,* by Joseph and others, contains seven parts, one of which is meteorology. In this book the 187 pages of meteorology make up a little less than one-fourth of the book.

Most of the texts used for General Science courses contain a unit on weather or climate. For example in *Science for Today,* by Caldwell and Curtis, Unit V, "How Weather and Climate Affect Us," covers 25 of the 712 pages. In *Problems in General Science*

by Hunter and Whitman, Unit XVII is entitled "Weather and Climate," and covers 26 of the 666 pages. *Everyday Problems in Science,* by Beauchamp and others, has a unit on weather called "What Makes the Weather Change." This unit contains 36 pages while the complete book contains 714 pages of subject matter. Consequently it is apparent that weather units in General Science are too short for the teaching of meteorology in a way to meet the objectives which should be obtained.

Meteorology, as a part of Physical Georgraphy, is not an innovation as far as textbooks are concerned, altho it may have been slighted in the high school classes. *New Physical Geography* by Tarr and Von Engeln, one of the earlier and most widely used Physical Geography texts, has three chapters on meteorology. However, only 87 out of 608 pages, or about one-eighth of the subject matter, is on meteorology. Two of the more recent texts for physical Geography are Fletcher's *Earth Science;* and Finch, Trewartha and Shearer's *The Earth and Its Resources.* Eight of the thirty-three chapters in Fletcher's book are on meteorology and climate, and about one-fourth of his subject matter is meteorology.

In the earlier Physical Georgraphy texts most of the subject matter is devoted to landforms, and meteorology receives minor treatment. Then, in 1941 with the publication of *The Earth and Its Resources,* appeared the first high school text presenting meteorology before landforms. In this book eight of the nineteen chapters and one-third of the subject matter deal with weather and climate. Out of the 196 pages on weather and climate, 132 are on meteorology. Moreover, the appendix, on Meteorological Instruments, and the Weather Map are much more elaborate and detailed than the treatment devoted to the same topic in the appendix of the other books mentioned. Thus we see that as new texts are being written for Physical Geography courses, the stress placed on meteorology has been increasing. Moreover, today many high school instructors in their Physical Geography courses are devoting more time to meteorology. Mr. Shearer, of the Westport High School, Kansas City, and co-author of *The Earth and Its Resources,* has an article in the September issue of the JOURNAL OF GEOGRAPHY entitled "Aeronautics and Geography."[1] Mr. Shearer believes that in a modern full-year course of physical geography or physiography

[1] Shearer, M. H. "Aeronautics and Geography," JOURNAL OF GEOGRAPHY, 1942. Vol. 41, pp. 228-233.

one "should devote, perhaps, an entire semester to meteorology and climate."[2]

The writer believes that the most expedient and desirable long-range plan to follow for most high schools in Illinois, and in the United States, for that matter, is to add meteorology to the curriculum by making it a unit in a year's physical geography course. About one-third of a year's physical geography course should be meteorology, and the weather should be discussed the first part of the class hour thruout the year. In the large and technical high schools a semester of meteorology could easily be offered. Army and Navy Air Forces are urging high schools to offer a semester of meteorology.

Another curricular problem is to decide in what year in high school meteorology should be offered. It seems logical that if meteorology were to be offered as a unit of physical geography it should be studied by sophomores and juniors. That a physical geography course should be a prerequisite for aeronautics is ably proven by Shearer in his article, "Aeronautics and Geography." Moreover, the writer believes that meteorology as a vital part of physical geography should be a foundation on which to build the social studies, the biological sciences, and other physical sciences. Certainly, physical geography should be a prerequisite to other high school geography courses such as Economic Geography, Conservation, and Political Geography.

PERSONNEL

Who should teach the meteorology course or the meteorological unit in Physical Geography? Certainly, no one who has not completed a college or university course in the subject should teach it. Moreover, from the standpoint of academic training the more meteorology a prospective teacher has had the better. Some colleges are now offering five semester hours in meteorology. College geography students who, as freshmen, have taken *Elements of Geography* by Finch and Trewartha, and who later have had a good course in more advanced meteorology should be well prepared to teach the subject. Moreover we find that some of our students take a two hour course in "Meteorology for Pilots" in a Civilian Pilot Training course or in some branch of our Armed Service. As a

[2] *Ibid.*, pp. 231.

result some of our geography majors have had a total of six semester hours in meteorology.

The high school teacher of meteorology in the future may be a young man who has flown an airplane in all kinds of weather and who has had a year's work in one of the Institutes of Meteorology. Two of our geography majors are now at the Institute of Meteorology in Chicago and two graduated in the November, 1942 class. Graduates from other colleges and universities are also attending and will attend these institutes. Moreover, some of our geography majors have had one or two years of actual experience in taking official United States Airway Weather Observations. Many of these well-trained young men if given the opportunity will teach meteorology in high schools when the war is over.

In the high schools where meteorology is offered as a part of physical geography, the teacher should be a geography major or minor with four semester hours of college meteorology. Moreover, the teacher if possible should have practical experience as an official weather observer or as a flyer. If I were principal, I should want a geography major or minor to teach the subject, because meteorology should not be a unifunctional unit for aeronautics, but a multiple-functional unit, as a basis for other subjects as well. I feel that meteorology should be taught so that its various phases will be equally treated instead of so that emphasis is placed solely on flying. I have discovered from my limited contact with instructors teaching a year of aeronautics that they would like nothing better than to have meteorology taught to their pupils in a physical geography course. Such a procedure would give the teachers more time for other phases of aeronautics.

If meteorology is offered as a part of physical geography, it should be required of all sophomores and juniors. We now live in an Air Age, whether we fly an airplane or not. Students should learn to think in terms of world atmospheric conditions and in terms of the world's physical environment as well as in terms of world political happenings. Such information and world understanding are as important for winning the peace as for winning the war.

BOOKS AND EQUIPMENT

For a semester course in Meteorology at present, I know of only one textbook, *Elements of Meteorology* by Finch, Trewartha,

Shearer and Caudle. To supplement this book, I should use Bulletin 25, *Meteorology for Pilots.*

Two of the best books on the market for a year's Physical Geography course that give adequate treatment to meteorology are: Fletcher's *Earth Science,* published by D. C. Heath, and Finch, Trewartha and Shearer—*The Earth and Its Resources,* published by McGraw-Hill.

In the high school library to be used with the Meteorology unit should be as many as possible of the following reference books:

Albright, John G.: *Physical Meteorology,* Prentice-Hall, Inc. New York, 1941.

Blair, Thomas A.: *Weather Elements,* Prentice-Hall, Inc. New York, 1942.

Bliss, George S.: "Weather Forecasting," Bulletin 42 of the U. S. Weather Bureau, Government Printing Office, Washington, D.C., 1939.

Brooks, Charles F.: *Why the Weather?* Harcourt, Brace and Co., Inc., New York, 1935.

Byers, H. R.: *Synoptic and Aeronautical Meteorology,* McGraw-Hill, Inc., 1937.

Climate and Man, 1941 Yearbook of Agriculture, Government Printing Office, Washington, D.C.

Codes for Cloud Forms and States of the Sky, Circular S. W. B. No. 1249, Government Printing Office, Washington, D.C., 1938.

Duncan, Richard: *Air Navigation and Meteorology,* The Goodheart-Wilcox Co., Chicago, 1930.

Gregg, Willis R.: *Aeronautical Meteorology,* The Ronald Press Company, New York, 1930.

Haynes, B. C.: "Meteorology for Pilots," Civil Aeronautics Bulletin 25 of the U. S. Department of Commerce, Washington, D.C., 1940.

"Instructions for Airway Meteorological Service," Circular N of the U. S. Department of Commerce, Weather Bureau, Washington, D.C.

"Instructions for Making Pilot Balloon Observations," Circular O of Aerological Division, U. S. Department of Commerce, Weather Bureau, Washington, D.C.

"Instructions for Modulated Audio Frequency Radiosonde Observations," Circular R of the U. S. Department of Commerce, Weather Bureau, Washington, D.C.

Meteorology, Special Test 193 of the Army Extension Courses, Government Printing Office, Washington, D.C.

Qamias, Jerome: "An Introduction to the Study of Air Mass Analysis," Bulletin of the American Meteorological Society, Milton, Mass., 1940.

Petterssen, Sverre: *Introduction to Meteorology,* McGraw-Hill Book Co., Inc., New York, 1941.

Shields, Bert A.: *Meteorology and Air Navigation,* McGraw-Hill Book Co., Inc. New York, 1942.

Starr, Victor P.: *Basic Principles of Weather Forecasting,* Harper Brothers, New York, 1942.

Sutchiffe, R. C.: *Meteorology for Aviators,* Chemical Publishing Corp., New York, Inc., New York, 1940.

Taylor, George F.: *Aeronautical Meteorology,* Pitman Publishing Corp., New York, 1940.

Trewartha, Glenn T.: *An Introduction to Weather and Climate,* McGraw-Hill Book Company, Inc., New York, 1937.

Weems, P. V. H.: *Air Navigation,* McGraw-Hill Book Company, Inc., New York, 1938.

Weightman, Richard Hanson: "Forecasting from Synoptic Charts," U. S. Weather Bureau Miscellaneous Publication 236, Superintendent of Documents, Washington, D.C., 1940.

I especially recommend the government publications because a small investment brings you all of them.

One of the weakest points in meteorological equipment is the paucity of workbooks. *Laboratory Exercises in Physical Geography* by Shearer is a supplement to *The Earth and Its Resources.* Clarence Koeppe's *Weather and Climate,* published by McKnight and McKnight in 1939 will be found useful.

Two of the small but useful governmental publications which every high school teacher should have if he teaches geography, whether it contains a unit on meteorology or not, are, namely: "The Illinois (or the state in which you live) Section of Climatological Data" and "Weekly Weather and Crop Bulletin." "The State Section of Climatological Data" is usually published monthly at state capitals by the Weather Bureaus, and can be secured for twenty-five cents a year. It contains data collected by the cooperative weather stations in your state. One of these weather stations will be somewhere near your high school, if not in your home town.

The weekly "Weather and Crop Bulletin" is prepared by the Weather Bureau, U. S. Department of Commerce, and is sent free to educational institutions or libraries.

Some of the chief criticisms made by our Armed Force Officers of the way geographers offer meteorology are:

1. That we do not stress accuracy and exactness
2. That we do not acquaint students with instruments nor give them the opportunity to work with instruments in laboratory and
3. That we teach the subject simply as an introduction to climatology.

These three criticisms can largely be met by offering laboratory work with desirable meteorological equipment. What would a minimum list of equipment include? Mr. Caudle, Coordinator, Civilian Pilot Training, University of Wisconsin, Extension Division, and co-author of *Elementary Meteorology* for high schools recommends as a minimum the following equipment:

1. Maximum and minimum thermometer
2. Psychrometer
3. Barometer
4. Wind vane
5. A simple cylindrical rain gauge
6. A subscription for the daily weather map.

The list is less elaborate than the equipment listed as necessary

laboratory apparatus for a year's course in physiography in Circular No. 298, entitled *Laboratory Equipment, Apparatus, and other Aids for High School in Illinois,* published by our Superintendent of Public Instruction in 1938. Few high schools have the equipment on either list.

In fact, many of the Geography Departments of the colleges and universities do not have the meteorological equipment recommended in Illinois Circular No. 298, nor do they all teach their students in a meteorological laboratory or by class demonstration how to use the equipment. Moreover, it is one thing to watch a person demonstrate a piece of apparatus and another to use it yourself in securing accurate meteorological data.

If the Geography Departments do not have adequate meteorological equipment for laboratory work to train teachers, then perhaps we should have the Physics or Physical Science Departments offer the work and we should send our majors and minors to these departments for their training in meteorology. In fact, if we do not meet the challenge of this rapidly growing laboratory subject, the work will be taken over by some other department. Meteorology will not stay suppressed any longer, nor will it as an introduction to climatology, be sufficient. Either college and university geography departments must offer a multiple-functional meteorology course with adequate equipment to serve aeronautics as well as geography, or some other department will.

Between one-fifth and one-fourth of the credit earned in a high school meteorology course should be obtained by working in both an indoor and outdoor laboratory. Without priorities you cannot buy meteorological equipment, but that will be no excuse for lack of equipment when the war is over.

A course in meteorology or a unit of meteorology may be offered without laboratory exercises or instruments, but we should recognize from the start that such a course is inferior and the teacher handicapped.

Not only should the high school student be given an opportunity to work with meteorological instruments at school, but he or she should be encouraged to set up an inexpensive weather station of his own if he has not already done so.[3]

[3] For detailed information refer to Barton, Thomas F., "Establishing an Inexpensive Weather Station," JOURNAL OF GEOGRAPHY, 1941, Vol. 40, pp. 226-230.

METHODS

If meteorology is to be taught as a textbook subject only, then it should not be added to the curriculum. Of course a good or excellent textbook is an important aid.

But daily description and interpretation of the weather as well as six to twenty-four hour weather predictions are vital in learning meteorology. The weather drama never ceases, and the scenes in our latitude are ever new. Fortunately, for interest as well as for physical vigor, the tempo of the drama is not monotonous. Each weather map is different. Some days the weather map and the weather can be discussed in a few minutes; on other occasions it may occupy half or all of the class time.

The daily observation of weather should be supplemented by the use of instruments in the laboratory and out of doors. If meteorological instruments are available, the students can take daily readings and code their findings as they would appear on the United States Weather Map. Then when the daily weather map comes a few days later they can enter their data upon it. This practice is followed by some Streator High School students as an extra-curricular activity, altho meteorology is not taught as a unit of study. With proper equipment, high school students could take observations and practice coding the data similar to the six hour readings taken by the United States Airway Weather Stations. In this way they would become interested in and familiar with teletype reports.

Field trips should be taken. Perhaps, it will be a field trip of an hour to visit the local Cooperative State Weather Station; or it may be a half-day trip to a Second Class Airway Weather Station near your school or to the Geography Department of a college or university. Then, if at all possible, a half-day or day should be spent at a First Class United States Weather Station and at a large commercial airport. Moreover, a trip to a large department store or factory to study modern heating and cooling systems will prove stimulating. The use made of weather instruments and the complex system necessary to control atmospheric conditions inside a building are instructive. It is to be understood that all of these trips should be carefully prepared by the class instructor and the person in charge of the place to be visited before the trip is made.

Films, both sound and strip, as well as glass slides and pictures,

are now available if priorities have not intervened. Erpi has just recently released a new sound film which is up-to-date in every way, including mass air analysis. The United States Weather Bureau is a source of excellent glass slides as well as of pictures and cloud charts.

A meteorology club could be established and meteorological news items carried in the high school paper and the club's official publication. One of the most successful Weather Clubs of the states is in the J. Sterling Morton High School at Cicero, Illinois. This club prepares a mimeographed monthly weather publication called the *Weather Vane*. The club has been in continuous existence since its establishment in 1932.

CONCLUSION

Administrators and teachers who hastily and haphazardly add meteorology to their curriculum can only do the subject harm. But with careful planning this important physical element of geography, weather, can be added to or enlarged in the curriculum at a time when a world crisis spotlights its importance in this field.

SUEZ—MEDITERRANEAN BACKDOOR ENTRANCE

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The North African campaign now being waged between Axis and British forces is but the latest chapter in an age-long struggle for Suez. Down thru the ages this narrow isthmus has been a bottle neck on the great highway twixt East and West. Located between the Red Sea and the Mediterranean it has usually functioned as a land portage tho occasionally with canal facilities, but always it has been a highly strategic link coveted in peace and in war.

A CANAL AN OLD PROBLEM

The need for a water connection to avoid portaging between the Red Sea and the Mediterranean was an ancient problem. From time to time a canal was actually opened only to later silt up thru neglect or be deliberately filled in to prevent enemy use. Little wonder then that with the phenomenal growth of world commerce the present waterway has, since its construction almost 75 years ago, played a prominent role in European commerce as well as in war and diplomacy.

DIFFICULTIES OF CONSTRUCTION

The ancient canals, predecessors of the modern Suez, actually joined the Red Sea (Gulf of Suez) with the navigable Nile. De Lesseps determined to avoid the hazards of navigation thru the Nile delta by cutting a waterway direct from the Red Sea to the Mediterranean. The advantage he gained was offset in small part by the greater length of the waterway and the fact that Nile mud is carried eastward by shore currents and must be prevented from clogging the canal opening by an expensive jetty.

Compared with Panama the engineering problems at Suez were simple. In the former the excavation was mostly thru mountains of rock; in Suez, almost wholly in a low plain of sand and mud. In fact much of the initial work at Suez was done by a great army of laborers with picks and shovels, using donkeys to remove the baskets of waste. As a consequence of the difference in elevation, Panama required an elaborate system of locks, while Suez is a sea-level type of canal. The difference in kind of material excavated has meant of course a much greater problem of "caving in" of the banks, for Suez.

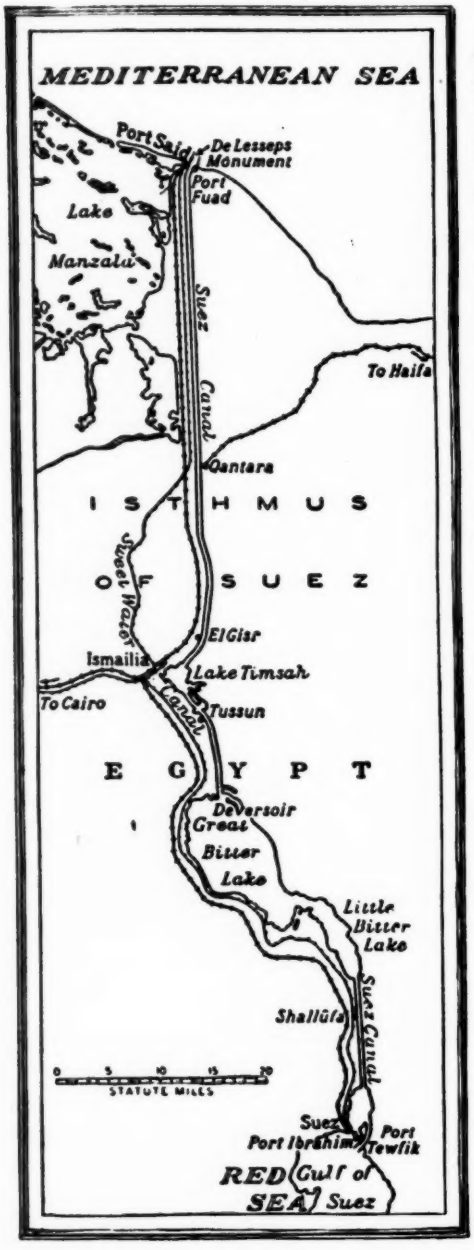


Fig. 1. The Suez Canal. Note the Sweet Water Canal that parallels the Suez.

An even more serious handicap at Panama was the climate. Heavy rains, high temperatures and dense jungle with its accompaniment of tropical diseases made the project a formidable undertaking. Desert conditions at Suez on the other hand were comparatively healthful. Engineers at Panama had to dispose of *excess* water; at Suez there was *no* local supply of fresh water for the workers. At first a camel caravan was used to carry Nile water across the desert, but the cost was high—some $2,000 a day. Eventually a "sweet water" canal replaced the caravan trail. It still functions and parallels the ship canal, as shown in Figure 1.

While the engineering problems at Suez were simple those of a political nature were not. England, then the greatest maritime nation and the richest, denounced the scheme as impracticable, refused to invest, and used all its influence on Turkey to place all the technical obstacles possible in De Lesseps' path. However, the Frenchman was a pastmaster in diplomacy and his patience and perseverance finally won the day. Not till the canal had been in operation for two years did England dispatch its India mail via the new waterway!

The canal was opened in 1869 the same year in which the first American transcontinental railway was completed. It naturally required some time for shipping interests to readjust their routings but after a few anxious years the traffic increased rapidly and it has remained one of the busiest links of any ocean route.

MAINTENANCE AND IMPROVEMENT

Improvements in the canal have kept pace with the rapid changes in maritime shipping. Widening has provided more passing points; straightening the course, reinforcing the banks against washing and using searchlights which permitted night travel have combined to cut the time for passage. In 1870 the transit required 48 hours; now it is about 16. Fortunately the steamship had appeared before the canal was completed for the uncertain winds practically rule out sailing vessels.

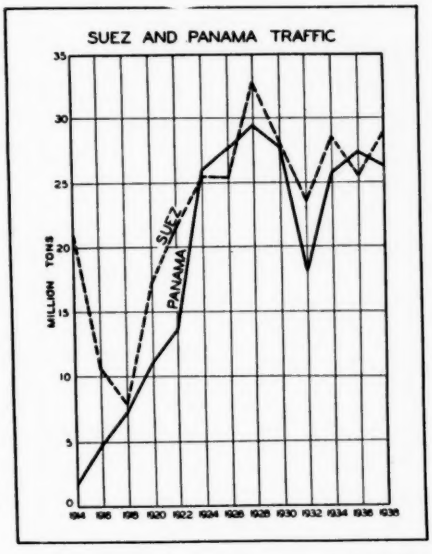


Fig. 2. Comparison of tonnage carried by the Suez and Panama canals.

REGIONS USING THE CANAL

The regions chiefly concerned with the canal are Europe on the west and the Far and Middle East on the east. The Indian trade via Suez is about equal to that of the Far East and more than double that of Australia. After all, the savings in distance the canal offers over the Cape Route for the London-Bombay journey are about 4 times that for the Sydney trip, as shown by Figure 3. For cheap bulky cargo such as Australian wheat canal tolls are more expensive than the added 1,000 miles of sailing via the Cape.

THE TRAFFIC

Suez traffic, like that of Panama, is not well balanced in the two directions. South bound cargoes, chiefly manufactures—average only about one-half the tonnage of those moving north—largely

raw materials. In spite of this handicap, however, the total movement is enormous. In a normal year some 6,000 ships carrying over 30,000,000 net tons of cargo pass and repass in that narrow gateway. As a rule the tonnage as well as the toll rates are a little larger than those at Panama. See Figure 2.

A PROFITABLE ENTERPRISE

The project has proven a bonanza, financially. Shares which originally went begging at 500 francs have been recently quoted at 18,000 francs. Dividends for the past half century were never under 25 per cent and in some years they were over 50 per cent. Tolls have

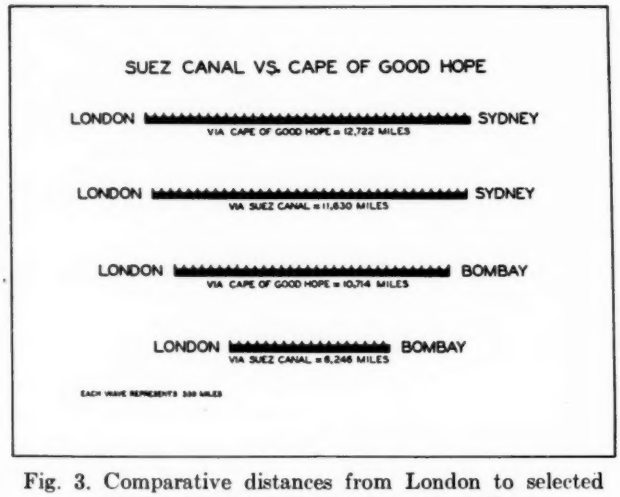


Fig. 3. Comparative distances from London to selected ports by way of Suez and Cape Good Hope.

been kept high—about all the traffic would bear—and complaints of shippers have been long, loud and in general, unavailing.

INTERNATIONAL ASPECTS

The waterway has long since ceased to be of interest only to the operating company or to Egypt. It is of vital importance to the whole shipping world, commercially and strategically. For England, it has been known as the "jugular vein" of its empire. It owns about 40 per cent of the capital stock and according to the treaty with Egypt in 1936 it has assumed the responsibility of protecting the waterway. Italy has long felt it was hemmed in by the Mediterranean bottle necks of Gibraltar and Suez and it was especially loud in its demand for a share in the control of the canal after it

acquired Ethiopia. The present concession expires in 1968 when the ownership of the canal reverts to Egypt; however, the interests of so many nations are at stake that it seems probable some sort of international agency will assume control after the present war.

SUEZ IN WORLD WAR II

Actual cargo movement thru Suez at present is probably negligible because of the dangerous Mediterranean passage. In fact wartime possession of the canal avails little unless there is also control of both coasts from Gibraltar eastward. Even in World War I with most of the Mediterranean countries friendly to the Allies, half of the British ship losses were in that sea.

Gibralter is too small for an air base and cannot prevent submarines coming and going at will. Malta is far more dangerous, hence its almost continuous bombardment by Axis planes. The drive of Axis forces along North Africa was designed to eliminate Allied bases along that coast, with Suez of course as the final goal.

Actual damage to the canal itself is not nearly as easy as in the case of Panama. In the latter a single bomb might damage the locks and tie up traffic indefinitely. At Suez this is not only impossible but it is not very practicable for even the defenders to block the channel for long. A ship loaded with concrete if sunk across the canal would only necessitate excavating around it—a comparatively simple undertaking. Control of the air is of course necessary if the canal is to be used, for ships in that long narrow passage would be easy targets for bombing by aircraft above them.

This is not to say of course that in addition to Suez there are not secondary worth while objectives of the invaders. The warehouses of Alexandria are bulging with accumulated stocks of the world's finest cotton which has been unable to reach Europe's markets. Likewise a bit farther east are the great oil fields of Iraq and Iran. Yet it is that 100 mile "ditch" thru the sands of Suez that Field Marshal Rommel wants above all else. As long as England retains its grip on that vital spot the Axis will find the Mediterranean a blind alley and eastward progress will be effectively checked.

THE MATTRESS-GROWING TREE—KAPOK

MARY FANTI
Jacksonville, Illinois

We in America have liked to believe the United States self-sufficient except for a few commodities scattered as far apart as the four corners of the earth. Our superb merchant marine has made even those few products almost as available as if they had been provided by nature within our own bounds. The world has grown smaller, we have said, as each successive invention has, in a way, annihilated time and space. Tho boat, plane, and wireless have made the world shrink, we have still to find the social formula that makes of this smaller world a brotherhood of man. As simple a product as the fiber of a tropical tree has shown us, in 1942, that it takes more than physical or material progress to keep a stream of goods moving from one shore to another. Kapok has added to our comfort for years, yet it is only now, since our source of it has been cut off, that we are taking a deeper interest in it. Our modern way of life has put it to dozens of uses, including its vital use in our war effort.

The History

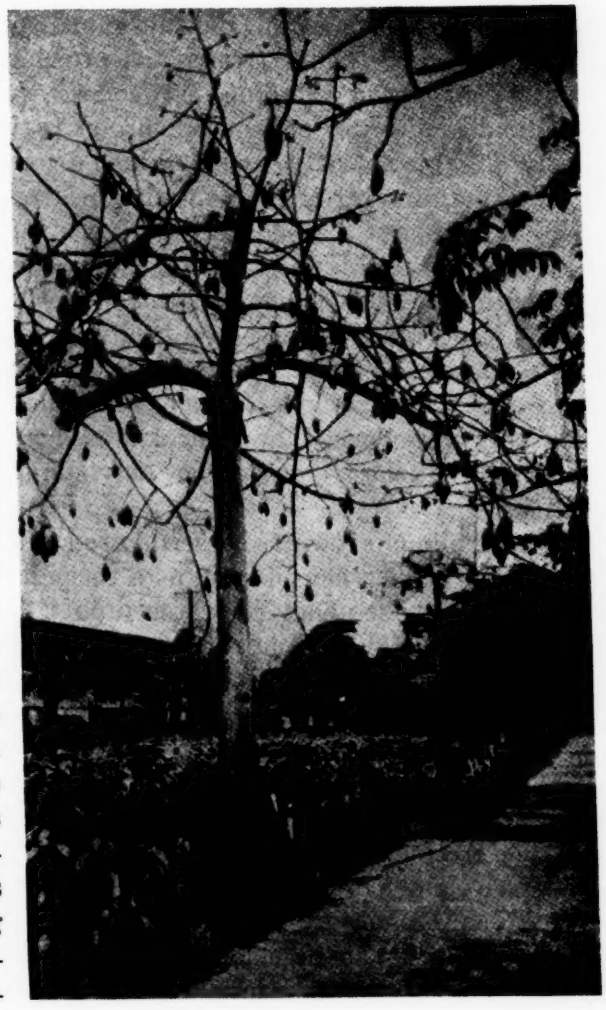
Because kapok has been used as a filling of mattresses for so long, it has come to be called the "mattress-growing" tree. To the botanist it is the "Ceiba Petandra." To those who man our planes and boats in the war over the seven seas it is the "life-saving" tree, for its fibers in life-saving equipment may be the factor that spells life or death when they are forced down over water. The Dutch in southeast Asia claim the tree has been known to them over three hundred years; the fibers of its fruit have been known commercially, however, for only a little over a century. As a product for export on a large commercial scale the tree began to be developed for its fibers about 1920. Its importance has continued to grow as it has begun to answer more and more needs in our way of life. Its prestige has won for it a singular recognition. The Army and Navy Munitions Board has placed it on our official list of "strategic commodities."

Where Found

The tree whose fibers we find so vital right now grows in tropical southeast Asia. It is common all thru the Philippines, India, Ceylon, Malay, and the Netherlands Indies, particularly the islands

of Java, Sumatra, and Madura. It is, however, not confined to Asia, for it is found in the tropical regions of Africa, Central and South America, and in the West Indies. In Australia and some of the South Sea Islands the tree is grown, not for its fibers, but as windbreaks and shade for smaller trees. By far, tho, the best grades of kapok come from the trees of the East Indies, particularly Java.

THE TREE



The kapok tree presents a characteristic appearance with its tall, straight trunk and sparse branches almost devoid of smaller limbs and twigs, growing at right angles from the trunk. It is an erect, quick-growing tree, reaching heights of fifty feet or more. Visitors to these islands come away with the feeling that the tree is as unique among trees as the giraffe or zebra is among animals. Since it offers little deep shade, it is often planted in rows to mark the boundaries of small native plantations or rice fields and to stand as living telephone or telegraph poles (See illustration). It is seen everywhere, growing wild along sides of roads or fields, on hillsides, or in home gardens. About ninety per cent of the kapok exported

from the East Indies is gathered from trees grown in this way, the remaining ten per cent originating from plantations under European management.

Physical Conditions for Growth

The physical conditions making for optimum yield and production on a commercial scale seem to be centered in the light, porous, well-weathered volcanic soils of Java and Madura. The tree thrives on the combination of tropical climate and rich volcanic soil. It does not want an excessive precipitation, needing no more than six feet of rainfall annually. Nor does it want the rain distributed evenly thruout the growing season. There should be the pronounced difference between the wet and dry seasons that is found in the wet and dry monsoon regions all thru southeast Asia. The tree not only can stand long droughts but welcomes them during the interval from the first appearance of the flowers until the harvesting of the pods, a period of five months, from January or February to June or July. It thrives best at altitudes of less than fifteen hundred feet, but this varies with the latitude. Site, too, is important. Overexposed locations where wind-damage during monsoons is imminent, dark and too-confined spots are unfavorable. The Javanese choice of spots along roadsides and riverside flats is governed by their knowledge, gained thru long experience, that the trees need not only sun and air but also proper drainage.

The saplings grown from seeds are set out about eighteen feet apart. The trees when planted as a secondary crop with coffee or cacao are set out about forty feet apart. Where the soil is rich, crops such as Manila hemp, sugar, coconuts, coffee, or cacao, being more remunerative, are the primary crops.

The Yield

During the fruiting period, which coincides with the dry season, the leaves drop off to reappear again at the end of the harvest season. The trees bear nominal crops of pods in their sixth or seventh year, the yield increasing until the limit is reached at about the fiftieth year. A mature tree of ten years yields six hundred pods or more, netting about six pounds of cleaned floss. Experienced hands are able to clean a large-sized tree in about fifteen minutes. On an average, five hundred pounds of floss per acre is considered a satisfactory annual crop.

HARVESTING AND PREPARATION OF THE FLOSS

The pods are ready for harvesting when they turn from green to brown and when deep wrinkles appear on the fairly smooth hull. The fruits, resembling misshapen cucumbers, are about five inches long and two inches thick. The natives stand on the thicker branches and detach the pods with a knife fastened to the end of a long bamboo pole. A picker must exercise care, for the fiber of an unripe pod can lower the quality of a bulk of fiber. The harvested pods are taken to a cleaning place where women sort the pods, throwing out unripe and unsound fruits. They are then taken to a factory where women break open the pods. The mass of floss, representing one-sixth of the weight of the pod, released from the husk resembles raw cotton. It is sent to drying compounds, level, open places entirely enclosed, and covered with fine netting to keep the fluffy kapok from being blown away. In the sunshine the kapok, swelling up to many times its natural bulk, is repeatedly turned over-by the natives using bamboo poles and standing waist deep in the billowy mass. After a thoro aeration, it is gathered again and put into a seeding machine. The seed bulk is small, altho in the pods it represents twice the weight of the fiber. After being blown again about the floor of the drying compound to remove every last trace of dirt or seed, it is compressed into bales, wrapped in gunny cloth or matting, and bound with hoops of galvanized iron or cane.

THE FIBER

Unlike the cotton boll, in which the fibers are massed about the seeds, the fibers of the kapok spring from the inner wall of the pod. The fiber consists of cylindrical hairs from one-half to one and one-half inches long. Each hair is made up of cells that form a hollow, air-filled tube. Each fiber is covered on the outside with a waxy substance that makes the buoyant fiber impervious to moisture. It is vermin-proof, in that there are no nutritive substances present. Nature's purpose in surrounding the seeds with buoyant hair was to make them so light that upon bursting of the pods the slightest breeze would carry the seeds away from the parent tree. Otherwise, the seeds falling beneath the tree, sprouting and developing close to the tree, would deplete the soil, and the older tree would die long before the young ones were old enough to bear and carry on the species. If the seed should fall into a stream, the buoyant fiber would keep it from sinking and sprouting under

water to decompose in time. The fibers bear a superficial resemblance to silky cotton or high grade wool. They differ from cotton in that they are short, straight, smooth, and cylindrical, in contrast to the long, flattened, tough, and twisted spiral fibers. The twisted cotton and serrated woolen fibers lend themselves to spinning, but the shortness, lightness, brittleness, and elasticity of kapok fibers that make kapok superior to cotton for many uses render it totally unsuited to spinning. Kapok has resisted all efforts to spin it successfully into yarn or weave it into cloth. Chemical or intense-heat treatment dissolves the ingredients of which the cell walls are composed and otherwise damages the fibers. Hence, it seems that kapok will not replace cotton or wool in those uses for which they seem the best suited.

Uses of Kapok

Filling. One of kapok's widest uses is as a filler in mattresses and cushions. Its resiliency prevents matting, and its waxy covering imparts both non-hygroscopic and non-absorptive qualities. Being free from vermin and insect infestation is another highly desirable quality of kapok. Its lightness makes it desirable for mattresses that must be turned regularly. Too, this same characteristic is an added advantage in its use by transportation companies for mattresses, cushions, and upholstery, where weight is an essential item.

Insulation for Temperature Conditions. The low thermal conductivity of the fiber makes kapok-filled mattresses cool in summer and warm in winter. This same quality makes kapok an excellent insulation for refrigerators. It is used extensively in refrigerator railway cars carrying highly perishable foodstuffs and in vehicles for road transport of vegetables, fruits, and milk. When Dr. Piccard made his famous stratosphere flight several years ago, his gondola was insulated with kapok against both solar heat and high altitude cold. Kapok was developed as an aeroplane insulation in 1936. Inside temperatures of trailers and automobiles are more comfortable as a result of kapok insulation.

Insulation for Sound and Vibration. The fiber of kapok has a great opacity to sound as well as temperature; therefore, it is used extensively where sound-proofing is necessary. By means of kapok, technologists have been able to dampen the noises and vibrations that come from a plane's mechanism. Its lightness entails a relatively small sacrifice of pay load. Its opacity to sound and vibra-

tion makes it a wonder fiber in the sound-film industry, movie theater, radio and movie studios, auditoriums, hospitals, homes, trains, and automobiles. Wherever the fiber is used for sound-proofing, it will at the same time, without added cost or weight, serve as a thermal insulator, giving protection against undesired heat or cold.

Kapok Batting. Kapok, by reason of its buoyancy, is more difficult to handle than cotton or wool fibers. Unable to solve the problem of producing a practical fabric with kapok, scientists producted a batting or sheet of kapok that can be cut or sewed. The kapok is stitched between flame-proofed cheesecloth or paper and then handled much like cloth. In this form it can be put to hundreds of insulating uses where the loose fiber would be difficult to handle. An interlining of kapok in a coat adds only ten and one-half ounces to its weight but makes it as warm as fur. In this form it is used for gloves for handling dry ice, sleeping bags, garments for winter sports, overcoats, quilts, and comforts.

Life-Saving Equipment. The buoyant quality of kapok opens up other uses for this versatile fiber. It is five times as buoyant as cork and, being non-hygroscopic, cannot be saturated, even after long immersion in sea water. Java kapok can carry between twenty and thirty times its own weight. In a test, thirty days of submersion resulted in only a ten per cent loss of buoyancy which was restored after exposure to the sun. Because of this quality it is vital for travel both in the air and on the sea. In the present war it is being used in waistcoats to be worn at all times by every person on board ships or planes. It is becoming standard material in life-saving equipment of many countries.

War Uses of Kapok. Other wartime uses of kapok are its use in buoys supporting flares guiding night flying and in floats for portable military bridges. Ninety pounds of kapok gives each pontoon a carrying capacity of three hundred pounds. Medical science is also using it for wound dressings.

BY-PRODUCTS

The revenue to the kapok grower is increased by a valuable by-product, the seeds. An acre of one hundred thirty-two trees yields one thousand pounds of seeds, forty-five per cent of whose weight is oil. It is yellow-colored, non-drying, practically tasteless and odorless; it closely resembles refined cottonseed oil. It can be put to all uses to which the latter is suited, being particularly adapted

to soap-making. Properly refined, it makes a good, edible oil. Marseille, France, was the largest buyer of this oil in the pre-war world. It is the sale of this oil that quite often puts the production of kapok on a profitable basis. The residue, or cake, left after the extraction of the oil is used as fodder for livestock or as a fertilizer containing nitrogen, phosphoric acid, and potash. Much experimenting has been done with the wood of the tree as a basis for a paper industry, but, so far, the pulp results in paper of an ordinary quality.

World Trade

The exhibition of kapok in the World's Columbian Exposition in 1893 by the Dutch accounts for the general interest in it after that date. It has become a commodity of world trade in the four decades since its introduction, its export increasing sevenfold since 1900. At present, world production of kapok is about thirty thousand long tons, of which the Netherlands Indies normally supplies between eighty-five and ninety per cent. Since about 1916 the United States has bought about one-half of the total kapok exports of these islands; today it is the world's largest consumer of kapok. The chief producing centers are the islands of Java, Sumatra, Ceylon, and the Malayan Peninsula.

Substitutes

Now that the source of this fiber, whose peacetime and wartime use adds so materially to our comfort and safety, is cut off, we in America have to look elsewhere for another source of this particular fiber or for an adequate substitute for it. The fiber from the trees of the Western Hemisphere and from tropical Africa are similar in appearance but deficient in those properties which make kapok valuable, namely, buoyancy, resiliency, resistance to water, and low thermal conductivity. As a result, they are of little or no commercial importance. Kapok has, in many instances, taken the place of cork, having proved itself superior. We cannot now turn back to cork since its source, too—the Mediterranean lands—has been cut off. Nor can cork act as a substitute for kapok in all its uses.

The fiber of the milkweed seems to be a temperate zone counterpart of the tropical zone fiber of the Ceiba Petandra. Tho these two fibers have diverse origins, they have remarkably similar characteristics. The pods of both are similar in structure and size and

both contain identical fibers. The fibers have the same degree of luster, lightness, softness, and buoyancy. The insulating qualities of the milkweed are a little better than those of the kapok. It is the conclusion of those who have studied and used kapok that milkweed fibers can be used as a substitute of equal or even superior quality. The ease with which this common weed grows in our country is solving the problem of securing this vital fiber. Once again necessity has proved to be the mother of invention, and again we have discovered a resource that will go far towards increasing our degree of self-sufficiency.

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TEMPERATURE EXTREMES IN THE UNITED STATES

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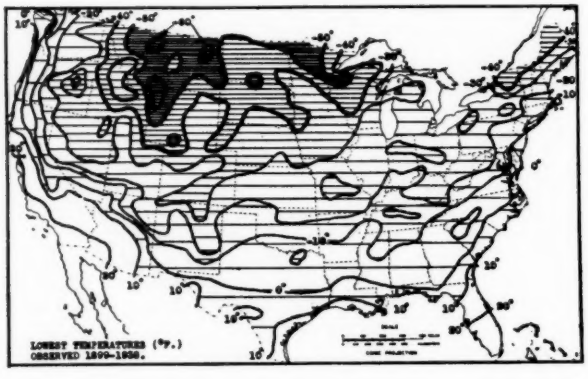
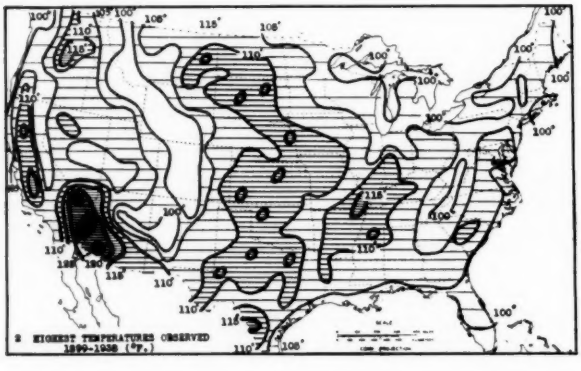
Maps of average temperatures are given in many geography texts. But annual averages fail to picture the true condition in a land where temperatures vary as much as they do in the United States.

Maps of the normal highest and lowest temperatures and the





extreme highest and lowest temperatures recorded officially in the United States during the 40 years 1899-1938 have recently appeared. They form a very small part of the 1941 Yearbook of the Department of Agriculture, which yearbook is called "Climate and Man." This volume contains much of interest to teachers of geography, and a copy should be in every school library. One valuable feature of the volume is a series of about seven small maps

for each of the states showing the temperature, precipitation and length of the growing season. Also are given in tables for each state the conventional climatic data for each of the weather bureau stations having a long record.

The two maps here given are redrawings of those of the highest and lowest temperatures officially recorded during 1899-1938. These redrawings are somewhat simplified and are shaded to increase their legibility. Altho the Yearbook does not discuss the reasons for the regional contrasts shown by these maps, the few paragraphs here given will be helpful to some teachers reading this little article.

The first of the maps here given shows that during the 40 years covered, zero has been recorded once close to the Gulf of Mexico, in northern Florida, and about 10° below zero has occurred in much of the South. On the Pacific Coast, however, the lowest temperature recorded was higher than 20° above zero in the south, and higher than 10° along the northern coast.

Along the Canadian border, temperatures of —40° or colder have been recorded, except near the Great Lakes and the oceans. The coast of Maine has not been as cold as —30° and the coast of Washington not as cold as zero. In the interior of the continent, quite a large area had —50° and three small areas in Montana and northwestern Wyoming had more than 60° below zero. The lowest for a station with a long record is —66° at West Yellowstone, in the National Park.

The much more extensive area of —30° in the western than in the eastern half of the country reflects the influence of greater elevation there and of less atmospheric moisture. Where the air is thin and dry, the loss of heat at night is especially rapid.

The influence of winds from off the Pacific Ocean is conspicuously shown on this map. Note that the lowest temperature recorded in western Oregon is 70° higher than the lowest recorded 600 miles to the east, across the mountains. The warmness of the coast is due in part to the effect of abundant atmospheric moisture, for the winters there are very wet. This abundant moisture yields heavy fog in cold weather, and much release of latent heat by condensation. This moisture factor is evident also along the east coast, where the isotherms tend to extend parallel close to the coast, indicating a sharp difference in temperature near the coast. Despite the fact that during the cold weather, the east coast has northwesterly winds blowing toward the ocean, coastal stations com-

monly are much less cold than are places only a few score miles inland.

The fact that temperatures of —10° and 0° have been recorded about as far south in the southeast as in Texas and New Mexico, where the elevation is higher and the air drier, is due to another condition. The "cold waves" are aspects of great Highs which move southeastward from Montana. Their progress is aided by the levelness and slope of the Mississippi lowland, with a result that they sometimes extend quite far southward before being greatly warmed by the more effective solar heating which prevails in the South in winter, and by the release of latent energy by condensation of moisture.

The second map shows the highest shade temperatures officially recorded during the 40 years studied. It shows that only small parts of the country have not had a temperature of 100° or higher. Those areas are left unshaded on the map. The largest is in the western mountains, the second largest is near the Great Lakes. Smaller areas which did not reach 100° during any minute of the 40 years were small coastal areas on the Pacific, Atlantic, and on the Gulf. This map reveals little clear influence of latitude, altho latitude effects are conspicuous in all maps which show annual average and winter temperatures. Note in this map that higher temperatures have been recorded in Montana than in New Mexico, in northern Maine than in southern Florida, and in eastern Washington than in southwestern California. A major reason for the relatively higher temperatures in the north than in the south is that in the hottest weather, the days are distinctly longer at the north than at the south. This is because the hottest weather comes shortly after the summer solstice, when the day is about 16 hours long near the Canadian border in contrast to about 14 hours long at the southern border. Another important reason why the mercury never rises as high in Florida and along the shore of the Gulf as in North Dakota is that relatively cool sea breezes temper the heat in hot weather. Also important is the greater amount of midday cloudiness in the South. Quite often there, thunderclouds develop in midday, checking a further rise in temperature. Such thunderclouds often develop in hot weather in the North also. Local differences in sunshine and cloudiness helps to explain some of the irregularities shown by this map. In the hottest minute of 40 years nearby places may have appreciably different temperatures be-

cause one was clouded during the hottest hour and the other happened not to be clouded over then. Also significant in causing irregularity on this map are local contrasts in altitude and slope, color of soil and presence of water bodies, such as lakes.

The highest shade temperature recorded at any weather bureau station with a long record during these 40 years was 134° in Death Valley, California. Other high temperatures were 130° in Imperial Valley, California, 127° at two Arizona stations, 121° at three Kansas stations, 117° at two northern Montana stations. All of these exceptionally hot areas were very dry at the time. The highest in the East are 116° in Indiana (2 northern stations), 111° in Pennsylvania, 110° in New Jersey, 108° in New York, 107° in New Hampshire, 106° in Maine.

These maps and data make clear that wide temperature extremes occur in the United States. The range is greatest in Montana and Wyoming (each 180°, from —63° to 117° and —66° to 114°) but is 160° in New York (—52° to 108°), 149° in Indiana (—33° to 116°) and 145° in Tennessee (—32° to 113°). Even in Georgia it is 123° (—12° to 111°) and in Florida 111° (—2° to 109°).

The chief causes for the great extremes in temperature are results of the position of the United States as part of a large continent in midlatitudes, where the sun is 47° higher in the sky at noon on June 21 than at noon on December 22. Of less importance, but still of real significance, are the variations in the weather associated with the cyclonic disturbances. Minimum temperatures are associated with Highs, some of which move rapidly from Canada to the southeast. Maximum temperatures are associated with dry, clear weather (drouth) which in summer usually is also associated with Highs, but Highs which move only slowly.

ILLUSTRATIVE MATERIAL FOR CONSERVATION EDUCATION. V. MAPS

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The location of our resources and of certain evidence of their use and misuse is most important in conservation education. A large amount of effective map material is available, much of it at reasonable prices. This material varies in size, format and usefulness. Some of the maps are designed for use by the entire class, others are suited to individual projects. There are slated maps which may be written upon with chalk; there are cellophane covered maps which may be marked with crayon; there are map stencils with which outline maps may be drawn on the blackboard. The basis of the map collection is, of course, the muslin-backed wall map, and the student outline maps. The map to be selected should be the one which best fits the need of the class and the study at hand. The following source list should aid in the selection of suitable maps for conservation education.

LIST OF MAP SOURCES

American Airlines Inc., 20 N. Wacker Drive, Chicago, Ill.

Time Zone Map of the United States. Free.

Coast and Geodetic Survey, Washington, D.C.

Large scale maps, compiled from air photographs, are available for certain areas along the coasts of the United States. In your inquiry, state the region in which you are interested. Index sheets illustrating and describing these maps are free.

Alaska. Size 24 x 46 inches, scale 1:1,000,000. 40 cents.

North Atlantic Ocean. Size 24 x 46 inches, 75 cents.

North Pacific Ocean. Size 14 x 41 inches, 25 cents.

Outline Map of the United States. Size 21 x 26 inches, 20 cents.

Denoyer-Geppert Co., 5335 Ravenswood Ave., Chicago, Ill.

Physical-Political Maps.

SS1-rp United States, 86 x 58 inches, $10.75 to $19.75.

S1-arp United States, 64 x 44 inches, $5.75 to $10.00.

S1-ar U.S. (Physical names emphasized) 64 x 44 inches, $5.75 to $10.00.

CS16 Slated U.S. Physical areas in extra black print, water areas in blue, 64 x 50 inches, $7.75. With world on reverse side, $10.75.

State and Regional Maps. Physical-political. Write concerning area in which interested. $6.25 to $9.00.

Phillips' Comparative Wall Atlas Maps. For human and regional geography. Each map 44 x 36 inches. Price $3.75 to $9.00.

P90 World, Annual Rainfall

P9v World, Natural Vegetation

PA8 Resources and Industries of the United States

P1v U.S., Natural Vegetation

P1s U.S., Summer Climate
P1w U.S., Winter Climate
A20 U.S., Resources and Conservation
A22 U.S., Agricultural

Re-mark-able Wall Outline Maps. Mark on them with crayon, wipe off, use again. Size 44 x 32 inches, two maps to a panel, printed back to back, $5.95.

Desk Outline Maps. Three styles; plain, sea tinted blue, and with mountains. Size 8½ x 11, 2 cents each; 11 x 16, 3 cents each; 16 x 22, 5 cents each.

Paper Wall Outline Maps. Lithographed blue on white, 48 x 36 inches, 25 cents each.

The George F, Cram Co., Inc., Indianapolis, Ind.

No. CSP1—*United States.* Physical-political wall map, 51 inches wide. $7.00 to $10.00.

No. CU1—*United States Unlettered Colored Outline Wall Map.* May be written upon with ink, water color, or special map-marking pencils. Marking may be removed with damp, soapy cloth. 51 inches wide. $5.00 to $8.00.

No. CN 1-5 *Comprehensive Series Maps.* Markable. $6.00 to $8.00.

CN1 United States, Natural Resources
CN2 United States, Mineral Resources
CN3 United States, Agricultural Resources
CN4 United States, Agricultural Products
CN5 United States, Manufacturing Industries

No. ZP *Reverso Panel Maps.* Colored outline maps mounted on panel boards, 38 x 44 inches. Take ink, water color, and map-marking pencils. Mounted two maps to a panel. United States on one side and South America on the other. Price $6.85.

The Forest Service, U.S. Department of Agriculture, Washington, D.C.

Requests for material should be addressed to the regional forester nearest you, or to the Washington office. Teachers are requested not to ask individual pupils to write for publications. If material is desired for class work the teacher may write for the whole class.

Natural Forest Regions of the United States. Colored, 18 x 24. Free.

Friendship Press, 150 Fifth Ave., New York, N.Y.

Picture Maps. 30 x 50 inches. Accompanied by insert sheet of 20 small sketches to be cut out and pasted on map. North America, United States; 50 cents each.

Game, Reforestation and Park Commission, Lincoln, Neb.

Full Picture Map of Nebraska. Free.

Geological Survey, Washington, D.C.

Write direct to the above address for information concerning topographical maps of your community, maps are 10 cents each.

Geologic Map of the United States. Scale 1:2,500,000. 4 sheets, each 27 x 47 inches, may be trimmed and pasted to make a single sheet 51 x 90 inches. Set, $2.50.

Geographic Features of the United States. Set of 25 maps that illustrate an interesting variety of geographic features. Set, $1.00.

Contour Maps that Illustrate Specific Physiographic Features. 100 select maps, $6.00.

Information Division, U.S. Bureau of Mines, Washington, D.C.

Map. Value of 1928 mine production of gold, silver, copper, lead, zinc, and iron ore of the United States by districts yielding $100,000 or more. Free.

McKinley Publishing Co., 809-811 North 19th St., Philadelphia, Pa.

Desk Outline Maps. Size 7½ x 10, 65 cents per 100; 10 x 15, $1.30 per 100; 15 x 20, $2.75 per 100.

Wall Outline Maps. Size 32 x 48 inches, 40 cents each.

Milton Bradley Co., 399 Codwise Ave., New Brunswick, N.J.

Blackboard Stencil Maps. 24 x 36 inches. 10 cents each. Available for each state; also for United States.

Bradley's Outline Maps. Size 11 x 14 inches; 60 cents for 50.

Mississippi River Commission, P.O. Box 80, Vicksburg, Miss.

Folder of 63 sheets, scale 1 inch to 1 mile covering Mississippi from Cairo, Ill. to Gulf of Mexico, 75 cents for folder.

National Geographic Society, School Service Department, Washington, D.C.

United States. Ten color wall map, 40 x 26 inches, shows towns, highways, railways, national parks, rivers, etc. 50 cents.

North America. Similar to above, but 28 x 38 inches. 50 cents.

A. J. Nystrom & Co., 3333 Elston Ave., Chicago, Ill.

Atwood Regional-Political Series. Size 52 x 60 inches. $8.00 to $11.25.

Parkins Series—Relief Like. Each 65 x 58 inches. Give perspective of dominant features of the earth. $9.75 to $13.50.

Finch Series. Environment shown by color layers symbolizing the surface features. $5.75 to $10.00.

Popular Series. Low cost political map. $2.00 on common roller.

Paper Wall Outline Maps. Lithographed on tough paper. Size 42 x 32 inches, 25 cents each.

Nystrom Desk Outline Maps. 8 x 10 inches, 1½ cents each; 10½ x 15, 2½ cents each. Maps include: weather, drainage, rainfall, and contour.

Gibsons Climatic Map of United States. Shows average monthly precipitation, mean annual precipitation, mean monthly temperature, mean annual temperature, prevailing winds. Size 65 x 45 inches, price $8.00 to $11.00 depending on mounting desired.

Economic Maps. For advanced pupils. Size 35 x 45 inches, price $3.00 to $7.25.

Hughes Natural Resources
North America—Rainfall and Temperature
World—Land Utilization

Erasamark White-Board Wall Outline Map. Markable maps each 42 x 32 inches. Use special color crayon. (25 cents for box of assorted colors) Mounted on Panels, two maps back to back on each panel. Each panel with two maps, $4.75. Come in the following combinations: United States-World, North America-South America, United States-Europe.

Rand McNally and Company, 111 Eighth Ave., New York, N.Y.

Ranally Physical-Political Series. Each 40 x 56 inches, $4.25 to $6.50.

Erasable Surface Outline Map. Takes crayon, water color, poster paints, India ink. Wipes off with a damp cloth. Size 40 x 30 inches, $3.00.

EOAW 101—United States
EOAW 100—North America
REOAW 906—U.S. and World (back to back, $4.50)

Blackboard Outline Map. Takes soft chalk. Size 46 x 66 inches, $6.00. World and United States, back to back, $8.00.

Wall Outline Maps. Size 40 x 30 inches, printed on tough paper. Each 35 cents. Available for world, United States, and North America.

Desk Outline Maps. Three sizes; 8½ x 11, 2 cents each; 11 x 14½, 3 cents each; 19½ x 11 inches, 5 cents.

Stanley Bowmar Co., 2929 Broadway, New York, N.Y.

Picture Maps. Collected from various publishers. First price is for map printed on plain sheet, second price is for map on muslin with plain rods at top and bottom.

Alaska, Last Frontier, 23 x 21, $1.00, $2.75
Cape Cod, 28 x 26, $1.50, $3.25
Conquest of a Continent, 24 x 18, $1.50, $2.75

Nation's Resources, 17 x 25, $1.00, $2.25
United States, 25 x 19, $1.00, $2.50

Superintendent of Documents, United States Government Printing Office, Washington, D.C.

Send for price list No. 53 Maps, for complete list of Government maps. Orders for these maps with money order, cash or check should be sent to the above address.

A 1.2:ag 8/5 *Geography of World's Agriculture.* $1.00.

A 36.37/2:f 22 *Farm Land.* Value of farm land and buildings. 10 cents.

A 13.28:f 76/2/937 *Forest Regions of the United States.* 5 cents.

C 3.61 *Land Office Maps.* Maps available for each state. 20 x 27. 10 cents each.

A 1.36:556/maps *Soil Conservation Survey Maps and Summarized Erosion Map of Southern Great Plains.* 21 maps. $1.50 the set.

I 21.13:Un 34/936 *Outline Map of United States.* 30 x 45 inches. 25 cents.

Official Map of the United States. 7 x 5 feet. $2.00.

Tennessee Valley Authority, Knoxville, Tennessee

Map of Tennessee Valley. Free.

Weber Costello Co. Chicago Heights, Ill.

Desk Outline Maps. Two sizes: 8½ x 11, 2 cents each; 11 x 16, 3 cents each.

STATE GOVERNMENT DEPARTMENTS AND AGENCIES

The following agencies distribute maps within their boundaries. Those outside these boundaries may usually obtain these maps at a nominal figure.

Arkansas Geological Survey, 477 State Capitol, Little Rock, Ark.
Delaware State Board of Fish and Game Commissioners, Dover, Del.
Iowa State Conservation Commission, Des Moines, Iowa
Michigan Department of Conservation, Lansing, Mich.
Montana State Planning Commission, Helena, Mont.
Nevada State Engineer, Carson City, Nev.
New Hampshire Forestry and Recreation Dept., Concord, N.H.
New York State Conservation Dept., Arcade Bldg., Albany, N.Y.
Oklahoma Geological Survey, Norman, Okla.
Pennsylvania Department of Forests and Waters, Harrisburg, Pa.
Tennessee State Department of Conservation, 310 State Office Building, Nashville, Tenn.
West Virginia Conservation Commission, Charleston, W.Va.
Wisconsin State Department of Public Instruction, Madison, Wis.

ST. LOUIS CAN BE BOMBED!*

(A Problem in Place Geography)

CHARLES F. SCHERRER
Rock Junior High School
East St. Louis, Illinois

St. Louis can be bombed. At least this expresses the opinion of many who purport to know, and on the basis of their belief, some preparation for defense has been made. They base their opinion on the assumption that St. Louis, like other inland river cities, lies open to enemy attacks from the air, because pilots can make use of the great river systems, which stretch out as positive guides to their objectives.

Lying directly across the river eastward, is our city of East St. Louis, with its many vital industries, which include the National Stock Yards and meat-packing plants, aluminum ore plant, fertilizer, chemical, zinc, and steel plants. Besides these industries, St. Louis has the distinction of being the second largest railroad center in the United States. Certainly East St. Louis is important enough a city to draw attention to its location.

DESCRIPTION OF THE PROBLEM

The problem to be discussed in this paper, arose in this manner. A nine-two General Science class had been studying cyclones in connection with a unit dealing with weather. A pupil was sent to a large blackboard-map of the United States, (which showed its physical features only) to point out a cyclonic area with its center within the St. Louis region. To the teacher's dismay, this pupil had no idea as to the location of this area. Another pupil was called, then another, and another, until most pupils in the class had been called. Finding no one able to locate the area, the teacher directed the class to a map of the United States, in their science textbook. The area was then discovered.

* This problem in geography arose as the result of a realization that St. Louis like many other river cities lies quite vulnerable to attack, if we accept the opinion of experts. There is little opportunity to "black-out" the nation's natural "highways" that flow past our doors. In spite of this apparent vulnerability of attack from the air on our river cities, the writer is appalled over the vast ignorance of many pupils regarding geographical locations of certain river cities, and he wonders if a remedy for alleviating this ignorance may not be found in appealing to the interests of the child by arousing a desire for reading materials that open to him the wealth of literature which deals with river lore in terms of romance and high, yet historically true, adventure?

This day's happening so concerned the teacher, that he wondered if the above condition was characteristic of other pupils in the Rock Junior High School.

To satisfy his curiosity and get a possible answer, he had maps prepared (physical maps of the United States showing rivers and mountains only; no outlines of states were shown). These maps were passed out to a number of seventh, eighth, and ninth-grade home-room groups so that over one-half of the pupils attending Rock Junior High had a chance to participate in the exercise. The pupils were handed the maps (blank side up) and at a given signal, were asked to turn the paper and place a small dot where they thought East St. Louis was located. After the dot was made, pupils designated whether they had attended the East St. Louis Public Schools only, or had attended out of town elementary schools, or had been enrolled in parochial schools of the city. The maps were then collected, scored and tabulated. The results of this test (in graphs) were then shown to the various science groups. The results so aroused the pupils' interests that the following story is told to show how the lack of place geography might prove very disastrous to any country.

A BIT OF SPECULATION

Assume the 400 Japanese aerial-pilots started from Tokyo, with the knowledge of place geography possessed by "our group" were assigned the bombing of East St. Louis, and each pilot was made responsible for one plane and one bomb; just what would be the outcome?

The results would be as follows: Four pilots would be unable to make up their minds where to drop their bombs in the United States (providing they could find the United States in the first place); twenty-seven only would score direct hits on vital spots in East St. Louis; one hundred sixteen would strike within a fifty-mile area of the city; (and they would have to reckon with Scott Field's wrath); twelve would cross the river into the environs of St. Louis County (never even realizing their mistake); two hundred and thirty-four would strike within a hundred mile area striking vital industries of the so-called "Forty-ninth State." In all, two hundred fifteen would reach the State of Illinois, as a depository of their charge. Twenty-three would strike within a hundred to five hundred mile area bombing such cities as Cincinnati, Ohio; Detroit, Mich.; Minneapolis, Minn.; Milwaukee, Wis., etc. The farthest from hitting

the mark, would be a bomb dropped in Wheeling, West Virginia, in the east, and one hitting Pocatello, Idaho, would be the farthest one in the west, which certainly proves that place geography is more vitally important to us now, than it has ever been before.

ANALYSIS OF DATA

Table I gives the results of scoring 400 maps. The writer is leaving the interpretation of the results to the reader, who may or may not be satisfied with the results that the study reveals. The tabulations show that the parochial and other schools credited with

TABLE I

SUMMARY OF ATTEMPT TO LOCATE EAST ST. LOUIS ON PHYSICAL MAP OF THE UNITED STATES. PUPILS WERE ASKED TO LOCATE EAST ST. LOUIS BY USING A SMALL DOT. ($\frac{3}{8}$ IN. EQUALS 100 MILES)

Data based on 400 cases expressed in %	Public %	Parochial %	Total %	7th %	8th %	9th %
Perfect Cases	.072	.047	.067	.085	.067	.052
Not Marking			.010	.010	.007	.011
No more than $\frac{1}{16}$ inch off. Must be in Illinois only	.310	.192	.290	.265	.277	.312
No more than $\frac{1}{4}$ inch. (67 miles)	.296	.409	.320	.265	.353	.323
No more than $\frac{1}{2}$ inch. (134 miles)	.145	.229	.162	.042	.060	.150
No more than $\frac{3}{4}$ inch. (200 miles)	.072	.096	.077	.021	.022	.040
No more than 1 inch. (267 miles)	.012	.022	.020	.042	.000	.023
Number in all grades farther than 1 inch, or (267–1200 miles)	.037	.022	.032	.053	.007	.057
Those marking in the state of Illinois	.552	.481	.537	.488	.601	.520

* Total 400; Public 317; Parochial 83; 7th—94; 8th—133; 9th—173.

the pupils' elementary training show no better score in pupil achievement than the achievements of pupils from the elementary public schools of East St. Louis. The writer expresses with humility, his ignorance of the status of place geography being taught in our schools at the present time, yet he is deeply concerned as a teacher and a parent over the fact that so many pupils at the high school level come unprepared to handle the "tools" given them to further their education at the secondary level. It sounds well and good that we should take the child where he is, when entering the junior high school, and bring him up to the level of knowledge and skill required to successfully execute his high school work, but it is trying on the patience of teachers who must teach boys and girls

TABLE II

PERCENTAGE OF CASES MARKING THE CONFLUENCE OF RIVERS OTHER THAN THE MISSISSIPPI-MISSOURI

Rivers	7th 94 Cases	8th 133 Cases	9th 173 Cases	Percentage Based on 400 Cases
Mississippi-Ohio	.107	.045	.122	.095
Missouri-Big-Sioux	.010			.002
Wabash-Ohio	.010	.015	.040	.025
Mississippi-Red		.007		.002
Mississippi-Arkansas		.007	.017	.010
Ohio-Kanawha			.005	.002
Colorado-Green			.005	.002
	.127	.074	.189	.138

a given unit of accepted experimental work, at the secondary level, if he must start every lesson from "scratch." This feeling of resentment is not appeased when on numerous occasions the writer hears of, or sees that in some elementary schools, maps are "conspicuous" by their absence.

This study reveals beyond any doubt that the concept of "*river,*" apparently runs deeply engraved in the minds of the pupil, for in spite of the fact that approximately 50 per cent failed to get within a hundred mile range of the confluence of the Mississippi-Missouri rivers, they at least placed a dot in localities where two rivers met; as is illustrated by approximately 10 per cent selecting the Mississippi-Ohio confluence. Some pupils were either very careless or ignorant of the fact that East St. Louis lies on the east bank of the Mississippi, as many miles south of the Missouri River, as 41 pupils had marked it north of the Missouri. Table II shows the percentage of 7th, 8th, and 9th, grade pupils locating East St. Louis at the *junction* of river systems other than the Mississippi-Missouri.

TABLE III

PERCENTAGE OF PUPILS; BY GRADES MARKING WITHIN 100 MILES OF SOME RIVER OTHER THAN THE MISSISSIPPI RIVER AND MARKING NO CLOSER THAN 200 MILES FROM RIVER JUNCTIONS

River	7th	8th	9th	Totals
Wabash	.107	.014	.023	.040
Arkansas	.032		.058	.032
Red	.032		.005	.007
Columbia	.032			.005
Missouri	.043		.023	.020
Colorado			.005	.007
Ohio			.005	.007
	.246	.014	.119	.118

Table III shows the percentage of pupils locating East St. Louis, on *some* river, other than the Mississippi. Only in .012 per cent of the total responses were locations placed more than one hundred miles from a river. There were only five cases where dots were placed at a maximum of 150 miles from any river. If we consider this as evidence of no thought given to the relation of the city to a river, then we conclude that about 88 per cent had the Mississippi River associated with East St. Louis.

THE WHERE AND THE WHY

In conclusion, we contend that in spite of the evident lack of emphasis now given place geography, that our pupils should be more observant when given sundry opportunities to observe place relationships. In this study there were at least two facts to be considered in making a perfect score; first, the fact that East St. Louis lies directly across from St. Louis, which in turn is but a little south of the mouth of the Missouri River; second, that on the map used the scale of miles was three-fourths of an inch to one hundred miles. There is no doubt that like knowing the multiplication tables, or knowing the alphabet, there are numerous times in the life of any individual when more adequate knowledge of the location of places would be satisfying and very beneficial. In this case we assumed knowledge of relationship between the Mississippi River and our city, East St. Louis. Could it be true that children are denying themselves, or thru the lack of instruction that we are depriving them of, many thrills afforded in story and in drama of the early life and travel of the Mississippi-Missouri rivers from the time of French and Indian days, thru the period of wood-burning boats, to the famous packets of yesterday, and up to the busy but ugly tugs and barges of today?

If this be the case, then certainly this study proves the vital necessity of teaching place geography in our elementary schools, our secondary schools, in our high schools, our colleges, and our universities.

EDITORIAL NOTES AND NEWS

During World War I, pork was sent in refrigerated ships to Great Britain mainly as Wiltshire sides. A Wiltshire cut splits the body bilaterally, after the head and feet are removed. Since adequate refrigerator space was unavailable in this present war, our packing houses have devised a method of dehydrating pork. When so prepared, the meat is a granular product containing about ten per cent of water. When properly packed and vacuum sealed, it does not need refrigeration. The lard is processed separately. Both the pork and lard so processed require *less than one-third* the shipping space needed for the same amount of pork sent as Wiltshire sides. Thus, where ten ships were needed to carry pork as cured Wiltshire sides, 3.12 ships will now carry the same amount when processed, the dehydrated meat requiring two ships, and the lard 1.12 ships. Dehydrated pork may be used to prepare any dish normally using freshly-ground pork.

Our attention has been called to an error in the price of the Australia and New Zealand booklet which we quoted on page 40 in the January issue of the JOURNAL. The price should have been listed as 15 cents. The booklet is one of the "Theatres of War Series" issued by the Institute of Adult Education, Teachers College, Columbia University, New York City.

Now that our supply of camphor is cut off from the Far East, particularly from Formosa where camphor trees are abundant, we are relying on synthetic camphor from turpentine. About 82 per cent of this camphor production is for plastics, and about 18 per cent for medicinal uses. Loss of our European market for naval stores is thus being mitigated somewhat by this and other chemical uses of turpentine and rosin. Altho the war demand for paints and varnishes for protective coverings is great, there is still a surplus for which the research chemist is trying to find a use. The many chemical uses of turpentine and rosin are far removed from those of the seventeenth century when the distillates from the pine tree's sap were called naval stores because of their use in caulking the seams of wooden ships and preserving their rigging.

Another phase of the quest for rubber is revealed by a series of experiments directed toward getting latex from a decorative vine known as Cryptostegia. Plantings are being extended in Caribbean areas. The rubber-yielding latex is found in both leaves and stems. How much is not known. A floss in the seed pods might have value as a kapok substitute, and a fiber from the stem might be useful for rope. Originally from Madagascar, the plant found favor in ornamental plantings in India. In both places a crude product known as "palay rubber" was marketed in small quantities.

Brazil is the one nation that can supply us with quartz crystals, essential in radio communication.

Argentina normally gets most of its imported coal from Europe. Since this supply has been cut off, the coal shortage has been so acute that railroads are reported to be burning a mixture of coal and corn. Factories, too, as well as homes are forced to burn

corn briquettes, and motors use gasoline mixed with alcohol distilled from corn. Still the fuel shortage is acute. So Argentina is hopefully looking toward the development of its coal deposits, especially those in the state of San Juan, according to reports by Dr. Serosso, Director of the School of Mines at San Juan. A recent discovery reports an outcrop in a valley where the veins are from 8 to 48 inches thick, with an estimated yield of 5,000 to 6,000 tons an acre. The coal can be reached by extending the railway from Jachal which is about a hundred miles north of the city of San Juan. Argentina's local petroleum supply cannot make up for the coal shortage. So Argentina looks hopefully to the Bolivian oil field which is reported to be sending Argentina 300 tons of crude oil daily. This oil is from the Bolivian Chaco. Argentina's own biggest oil field is south of Buenos Aires, at Commadoro Rivadavia, a production great enough to put Argentina in the ten ranking oil-producing nations of the world.

A mine in Idaho is now the world's greatest producer of tungsten. The fact it could yield tungsten in commercial quantities was not known till in 1942.

Another successful negotiation of the Northwest Passage, the only one since Amundson's achievement in 1906, was recently made by a Royal Canadian Mounted Police patrol ship, the St. Roch. The expedition left Vancouver and landed at Sydney, Nova Scotia, after a voyage of two years and three months.

A half million dollars could easily be made every year if papaya cultivation were developed in Caribbean America as it has been in the Far East. The United States normally buys annually that amount of papain, the dried latex obtained from the papaya fruit. It is obtained by collecting the latex that drips from cuts in the green fruit. This extraction does not prevent the ripening of the fruit which may be eaten fresh. Papain has a digestive enzyme resembling pepsin. It is used as a drug and also in tenderizing meat.

GEOGRAPHICAL PUBLICATIONS

Roderick Peattie. **How to Read Military Maps.** 74 pp., 19 illustrations. George W. Stewart, New York. 1942. $1.50.

As stated on its overcover this book is written for the Selectee, Prospective Officer, WAAC Volunteer, Home Defense Guard, Aviator, and the Arm Chair Strategist. Also included on its overcover is the statement that it is a simple, non-technical description of contour maps upon which military operations are based.

This book does fulfill this mission for its prospective readers and students. It is a direct and streamlined exposition of the invaluable use of geographic symbols in maps and charts, in military operations. Any one of the above intended users can read it readily and understand its purpose and application to real situations on the actual battle front. The maps, charts, and text are clear and associated with actual military maneuvers. The author draws effectively from his experiences in World War I as an Engineer serving on the battle front in France. His problem situations such as "Pick Up a Hundred Wounded at Rathbone" bear the stamp of actuality and can be solved with the text and maps in a realistic way. The book is small enough to be carried about as a manual and could be very helpful to those whose duties will in any way associate them with the lay of the land. Furthermore geographers in general can profit from reading the book since they are too prone to be abstract and remote in dealing with every day practical geography problems.

J. R. SCHWENDEMAN

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Samuel Van Valkenburg, Ellsworth Huntington, Wallace W. Atwood, Jr., W. Elmer Ekblaw, Clarence F. Jones, and Earl B. Shaw. **America at War.** 296 pp., 54 illustrations. Prentice-Hall, New York. 1942. $2.50.

This book consists of nine chapters written by six geographers, each of the six being responsible for one or more chapters. According to the preface the book was written "to put the geographical point of view on the war—seen from the American angle—before the public."

The chapters are as follows:

1. The Quality of the People—Huntington
2. Our Land and Its Coastline—W. W. Atwood, Jr.
3. Terrain and War Strategy—Van Valkenburg
4. The Climatic Factor—Van Valkenburg
5. Foods for Defense—Ekblaw
6. Industrial Capacity and Supplies of Raw Materials—Jones
7. United States Atlantic Defense—Shaw
8. United States Pacific Defense—Shaw
9. America and Peace—Van Valkenburg

To the reviewer most of the chapters are material which the writers have published previously or have read in papers before scientific societies. It seems as tho they have dug into their files and contributed a chapter or two each to bind together into a book which they hope will contribute to the United States war effort. The result is a book which lacks continuity of thought. The last chapter comes closest to making a new contribution.

It is doubtful that the volume will be much used as a text. It will not displace texts in political geography and is hardly adequate for a new course in geopolitics. It

can be used as supplementary reading for undergraduates in the social sciences and it may be read by the reading public of above average education.

There is much in the book that belongs to the fields of economics, history, political science, nutrition, and sociology. When geographers dip into these fields they only add fuel to the struggle between the social scientists as to who shall teach what. Even the title of the book gives the authors much latitude. When geographers write books which they hope will be adopted as textbooks, why not have the word "geography" in the title? Are we ashamed of our calling; do we wish to dip into all social science fields; or do we hope to sell the book in a large market?

C. E. COOPER

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James Fairgrieve. **Geography and World Power,** 376 pp., maps. E. P. Dutton and Co., New York, 1941.

This stimulating political geography book by the prominent British geographer, James Fairgrieve, was first introduced to the public in 1915. The eighth and revised edition, published in 1941, is receiving considerable current attention. In his preface the author states his attitudes thus: ". . . there is really some order in the apparently disorderly happenings on this planet. The stage is set partly by natural forces, but the setting is continually being changed by the actors, in course of time greatly changed, and this new setting in turn affects the scenes that follow."

The author has no inhibitions relative to the use of the word "control." In his opening paragraph he says: "This book is written to show how the history of the world has been controlled by those conditions and phenomena which we class together under the title of geography and to point out which are the really outstanding geographical facts by noting those which have most effectively controlled the history."

The thesis that history is the story of man's increasing ability to control energy which is presented in an introductory chapter is applied in the eighteen chapters that follow. Their titles suggest the author's approach but do not reveal the interesting treatment he gives them.

ADELBERT K. BOTTS

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Harold B. Ward and William E. Powers. **Weather and Climate.** 112 pp. Illustrated. Northwestern University, Evanston, Illinois. 1942.

This text, according to the authors, is an introduction to the study of weather and climate, presumably for secondary schools. All units are brief. Only the most elementary principles and laws of gases are included. Mathematical computations and charts are simple. The book begins with a brief discussion of the earth's spacial relations and its measurements in terms of latitude and longitude. The physical and chemical composition of the atmosphere is followed by its relation to solar insolation. Each weather element is briefly discussed and the instruments given by which it is measured. How the planetary winds become modified becomes evident from the discussion of local wind phenomena, including cyclonic disturbances and their fronts. The basic principles of weather forecasting from data on the daily weather maps are given along with some simple observations to make, which are helpful in forecasting without a map. The book ends with a brief characterization of the various climatic zones of the world.